

DESCRIPTIONS OF NEW AND LITTLE KNOWN ETHEOSTOMOIDS.

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The present paper is occupied chiefly with the description of new *Etheostomoids* collected during the summer of 1884, in the course of a series of explorations of streams of the South and Southwest, undertaken in the interests of the U. S. National Museum. The writer was associated with Prof. Joseph Swain in field work in Indiana, Kentucky, Tennessee, and Alabama; with Prof. S. E. Meek in Southwestern Missouri; and with Prof. D. S. Jordan in Arkansas and Texas.

Types of all of the new species here characterized have been deposited in the National Museum, their numbers on the Museum register being cited at the beginning of the descriptions.

The species described come under the current genera *Ulocentra*, *Cottogaster*, *Hadropterus*, *Rhothæca*, *Etheostoma*, and *Alvarius*. It is not believed that these now admit of satisfactory generic characterization, and they are here recognized as convenient subgeneric divisions only. Characters based in this group on the protractility or nonprotractility of the premaxillaries, the union or non-union of the branchiostegal membranes, and the completeness or incompleteness of the lateral line, may indicate real affinity, but I think we are hardly prepared to insist that they always and of necessity must do so.

What are apparently geographical varieties have been described in order to call attention to them. Their claim to subspecific rank cannot be established until further exploration shall have determined the limits of variation within the species. The entire question of the recognition of subspecies among the *Etheostomoids* must for the present be treated as an open one.

1. *Etheostoma* (*Ulocentra*) *histrionicum* Jordan & Gilbert, sp. nov. 36356, 36409, 36443.

In form much resembling *Etheostoma zonale*, but the body slenderer and less compressed, and the anterior profile of head more declivous, the mouth being on a level with lower portion of base of pectorals. Mouth small, horizontal, subinferior, the lower jaw included; maxillary reaching vertical from front of pupil, $3\frac{3}{4}$ in head. Eye rather large, high up on sides of head, its diameter much greater than length of snout, 3 in head. Interorbital width half vertical diameter of orbit. Parietal region narrow, smooth, rather strongly arched. Opercular spine little developed. Gill-membranes broadly joined across the isthmus. Premaxillaries technically protractile, the upper lip everywhere separated by a fold from the skin of the forehead; they are, however, very little movable.

Vertical fins small, the paired fins greatly developed. Spinous and soft dorsals separate, nearly equal in height and extent; the longest

dorsal spine half length of head, the spines all slender and weak. First anal spine longer and stronger than the second, slightly longer than snout. Caudal fin emarginate, less than length of head. Pectorals much longer than head, reaching beyond tips of ventrals to vent, their length nearly one-third that of body. Ventrals about as long as head.

Scales etenoid; lateral line complete, not decurved; head naked, or with a few scales on opercles; nape completely scaled; breast, and a long strip behind ventral fins, naked, the posterior half only of ventral region scaled over. No enlarged humeral scale.

Head, 4 to 4 $\frac{1}{4}$ in length; depth, 5 to 5 $\frac{1}{2}$. Lat. 1. 50 to 54, 5 $\frac{1}{2}$ series between it and base of spinous dorsal. D. X-13; A. II, 7. L. 1 $\frac{3}{4}$ inches.

Color: Body very dark green; back with 7 light cross-bars usually very distinct; ventral region light, the lower half of sides marked with light and dark greenish, these markings showing a tendency to form bars usually alternating with those on back. Top of head dark, the sides light greenish; a broad dark bar from eye to tip of snout, one below eye, and a broad dusky area covering parts of opercle, preopercle, and cheek. A dark bar in front of pectoral fins, and several transverse series of dark spots on under side of head. Fins all conspicuously marked with broad bars of light and dusky greenish. A black humeral spot. Males show traces of this plan of coloration, but are more uniformly dusky greenish; the lighter markings much less conspicuous.

Abundant in the Poteau River, near Hackett City, Ark. Found also in the Saline River at Benton, Ark., and in the Washita River at Arkadelphia.

2. *Etheostoma (Cottogaster) uranidea* Jordan & Gilbert, sp. nov. 36413.

Allied to *Etheostoma shumardi*.

Form elongate, terete, very little compressed; upper profile gently arched, the lower almost straight; caudal peduncle short and very slender; upper profile of head descending in a long gentle curve to the sharp snout. Mouth terminal, nearly horizontal, the lower jaw included; premaxillaries on a level with lower margin of orbit; maxillary reaching beyond vertical from front of orbit, 3 $\frac{1}{4}$ in head. Premaxillaries protractile, the fold very narrow. Eye equaling length of snout, 3 $\frac{3}{4}$ in head, nearly twice interorbital width in a specimen 2 inches long. Opercular spine well developed; preopercular margin entire. Parietal region rather broad, depressed, the bones rugose. Gill-membranes very slightly joined at base. Cheeks mostly naked; opercles closely scaled. Breast naked, or with a few scattered scales. Paired fins rather small, the vertical fins long but rather high. Membrane of first dorsal not joining base of second. Longest dorsal spine about equaling distance from tip of snout to middle of orbit; soft rays half as long as head. Caudal fin deeply emarginate. Anal spines very short, about equal in size, as long as diameter of orbit. Soft rays of anal high, the fin rather larger than second dorsal. Pectorals and

ventrals short, reaching about the same vertical, not nearly to vent; length of pectorals nearly equal to head.

Scales of moderate size; nape completely invested; a wide naked strip on each side median line of belly, the latter containing a single series of thin, elongate, plates, weakly spinous on posterior margins; lateral line complete, parallel with outline of back.

Head, $3\frac{1}{2}$ to $3\frac{2}{3}$ in length; depth, $5\frac{2}{3}$. D. XI-13; A. II, 10 or 11. Lateral line 48 to 56, $6\frac{1}{2}$ series between pores and dorsal fin.

Color in spirits: Greenish olive, rendered dusky on upper parts by black specks, which become large and very conspicuous on top of head, opercles, and sides of snout. Four conspicuous dark cross-bars, narrower than interspaces, downward and forward from back to lateral line: the first from anterior dorsal spines, the second from space between dorsals, the third from posterior half of soft dorsal, the fourth from caudal peduncle. A series of about 11 dusky blotches on sides immediately below lateral line. A black bar before, one below, and one behind eye; the one below eye very distinct. Dorsals, pectorals, and caudal barred with light and dark; ventrals and anal plain. In life, the colors were similar, there being no distinct blue, red, or green.

Several specimens, varying from $1\frac{1}{2}$ to 3 inches in length, from Washita River at Arkadelphia, Ark.

3. *Etheostoma* (*Hadropterus*) *ouachitæ* Jordan & Gilbert, sp. nov. 36449.

Body elongate, slender, comparatively little compressed, in general contour much resembling *E. uranidea*. Head slender, the snout not blunt, the upper profile descending in a long gentle curve. Mouth moderate, narrow; premaxillaries on a level with lower part of orbit, non-protractile; lower jaw included; gape nearly horizontal; maxillary reaching vertical from front of orbit, its length slightly greater than snout, $3\frac{1}{2}$ in head. Eye equaling snout, $3\frac{1}{4}$ in head. Gill-membranes scarcely joined across isthmus.

Fins of moderate size; longest dorsal spine $2\frac{1}{4}$ in head, the longest soft ray more than half head; anal spines short and weak, the two nearly equal, their length equaling diameter of orbit. Caudal emarginate. Pectorals reaching to opposite tips of ventrals, as long as head.

Scales moderate, rough; lateral line complete, straight; opercles and nape scaled; cheeks smooth, naked or covered with imbedded scales; breast naked. Middle of belly naked, without series of enlarged plates in our specimens. An enlarged spinous scale between bases of ventral fins.

Head 4 in length; depth $6\frac{1}{2}$; D. XI or XII, 13; A. II, 10. Lateral line 52 to 56; 6 series of scales between lateral line and base of spinous dorsal. Length 2 inches.

Color: Olivaceous, back more or less tessellated with dark brownish, the margins of the scales dusky. Five rather faint dark bars from the back downward and forward to lateral line: the first under front of

spinous dorsal and the second under its last rays, the third under middle of soft dorsal and the fourth immediately behind it, the fifth a mere cross-blotch on back of tail. On middle of back these bars are narrower than the interspaces, but grow much wider downward. Middle of sides with a series of 8 or 9 quadrate dusky blotches, more or less confluent, as in *E. aspro*. Below pale, unmarked. Dorsals, caudal, and pectorals more or less evidently barred with light and dark; ventrals and anal unmarked. No bright colors in life.

Several specimens from the Saline River at Benton, Ark.

4. *Etheostoma (Hadropterus) squamatus* Gilbert & Swain, sp. nov. 36652.

Body elongate, the sides and caudal peduncle compressed; back elevated, the profile forming a slight angle at occiput; head very long and slender, with a long acuminate snout, as in *E. phoxocephalum*, which this species somewhat resembles in appearance. Cleft of mouth long and narrow, the lower jaw included in closed mouth; maxillary reaching vertical from front of orbit, its length equaling that of snout, $3\frac{1}{2}$ times in head; upper jaw not protractile. Bands of teeth very wide, the outer premaxillary series enlarged. Vomerine patch well developed. Eye moderate, $1\frac{2}{5}$ in snout, $4\frac{3}{4}$ in head to end of opercular spine, $2\frac{1}{2}$ times the furrowed interorbital width. Preopercular margin strictly entire. Gill-membranes widely united across isthmus.

Spinous dorsal long and low, spines from the 3d to the 10th subequal in length, those anteriorly and posteriorly gradually shortened; longest spine one-third length of head. Spinous and soft dorsals well separated. Base of soft dorsal equaling one-half the distance from its origin to front of spinous dorsal. Anal shorter than soft dorsal, but higher and inserted more anteriorly; anal spines strong, the first slightly the longer, about equaling length of snout. Highest anal ray nearly half length of head. Caudal emarginate, the lobes rounded, $1\frac{1}{3}$ in head. Pectorals equaling length of head behind front of eye. Ventrals $1\frac{3}{5}$ in head.

Body covered with very small scales, uniform in size, and completely investing the ventral region, which is without series of enlarged scutes. Cheeks, breast and nuchal region covered with still finer scales having entire edges, and the opercle with larger spinous scales; interopercle and part of subopercle naked. An enlarged black humeral scale.

Head, $3\frac{3}{7}$ in length; depth, $5\frac{1}{2}$. D. XIV-13; A. II, 10. Lateral line 82; 10 series between lateral line and middle of base of spinous dorsal, 18 in a vertical series from lat. 1. to middle of belly.

Colors in life: Yellowish-olive, with about 10 broad dusky bars across the back, and an equal number of dusky blotches along lateral line; a conspicuous black humeral spot; a broad black line forward from eye to snout, and a narrower line backward from eye to upper preopercular margin; opercle and occiput largely dusky. A diffuse dusky blotch at base of tail, with a small, round, jet-black spot behind it. Spinous dorsal translucent, with a broad subterminal brownish-orange band;

soft dorsal and caudal barred with dusky and orange-yellow. Pectorals slightly reddish. Ventrals translucent.

A single specimen, 3.9 inches long (numbered 36652 on the catalogue of the National Museum), was taken by the writer and Prof. Joseph Swain in the French Broad River at the mouth of Wolf Creek, Tennessee. It was found in very rapid water, lurking under the stones.

5. *Etheostoma* (*Hadropterus*) *cymatotænia* Gilbert & Meek, sp. n. 36215, 36308, 3-260.

Body robust, comparatively little compressed, the ventral region very prominent, rounded, the dorsal region scarcely elevated; dorsal and ventral outlines converging rapidly towards caudal peduncle, which is very narrow and expands abruptly behind to form a broad basis for the caudal fin. Head short, tapering rapidly forwards, the snout not blunt, short and slender. Mouth small, oblique, the lower jaw included. Maxillary nearly reaching vertical from front of orbit, about $4\frac{1}{2}$ in head. Teeth in very narrow cardiform bands, the outer series in both jaws rather conspicuously enlarged. Eye large, about equaling snout, 4 in head. Cheeks, opercles, nape and breast covered with large scales, those on cheeks smaller than the others. Preopercular margin entire. Gill-membranes narrowly joined across isthmus, the union being in most cases hardly perceptible, but in one specimen quite broad.

Spinous dorsal rather short and high, the first spine but little shorter than the second; anterior spines highest, the outline of the fin thence declined; highest spine equaling half the length of the head. Soft dorsal small, quadrate, as long as high, its base but little more than half that of spinous dorsal; its longest ray $1\frac{3}{4}$ in head.

First anal spine very strong and robust, much stronger than any of dorsal spines, or than the second anal spine; its length equaling distance from snout to center of pupil, equaling or slightly exceeding that of second anal spine. Anal larger than second dorsal, its base slightly longer, and the rays higher, the longest ray $1\frac{1}{2}$ or $1\frac{3}{4}$ in head. Caudal slightly emarginate. Pectorals short, not reaching tips of ventrals, the two about equal in length, equaling head behind nostrils.

Body covered with large rough scales, everywhere spinous but with a tendency to smoothness on the breast. Ventral region completely and uniformly scaled without median series of enlarged plates, two or three of which only are visible between the ventrals.

Head 4 to $4\frac{1}{4}$ in length; depth 5 . Lateral line 64 to 70 ; 7 scales from lateral line to middle of spinous dorsal, 12 to median ventral line. D. XII to XIV- 12 to 14 ; A. II, 10 .

Colors in life: Above and on sides greenish, made very dark by fine, close-set, punctulations. Two pairs of light streaks along sides, narrower than interspaces, becoming yellowish in spirits; the upper pair from the nape running along each side of dorsal, inclosing between them a

dusky streak occupying median line of back; the lower pair from above opercles running in a wavy course above lateral line to upper caudal lobe. Below this and bounded by it, occupying the middle of the sides, is a broad, dusky moniliform band. Lower part of sides and ventral region light olive, dusted sparsely with rather coarse black specks. A small jet-black spot at base of caudal. A broad black bar (sometimes obscure) on head, from snout through eye across upper part of cheeks to opercular spine. Sometimes a series of small black cross-blotches on median dorsal line. Fins translucent, barred with dark lines.

Abundant in the Niangua River and the Osage Fork of the Gasconade, near Marshfield, Mo., and in the Sac River, near Greenfield, Mo. Numerous specimens were taken, and are numbered 36215, 36308, and 38260 on the register of the National Museum.

6. *Etheostoma (Hadropterus) nianguæ* Gilbert & Meek, sp. nov. 36214.

Body elongate, terete, the sides somewhat compressed, becoming more so posteriorly; back elevated, the profile descending gently in an unbroken line from front of dorsal to tip of snout. Head very long and slender, much as in *E. macrocephalum* and *phoxocephalum*; the snout comparatively deep and narrow, abruptly rounded vertically at tip. Mouth large, the cleft wide and slightly oblique, the maxillary reaching beyond front of orbit, its length equaling distance from snout to front of pupil, $3\frac{1}{2}$ in head (the latter measured in this description to end of opercular spine). Outer series of premaxillary teeth somewhat enlarged; the bands all broad. Eye slightly less than snout, $5\frac{1}{2}$ in head to end of opercular spine; interorbital space convex transversely, its width about three-fifths diameter of eye. Cheeks perfectly smooth, with a few scattered embedded cycloid scales; opercles and breast strictly naked; nape and ventral region closely scaled. Preopercular margin entire. Gill-membranes scarcely joined across the isthmus.

Spinous dorsal short and high, the first spine much shorter than the second, the seventh and eighth about equal, the longest $2\frac{1}{4}$ in head. Soft dorsal high, its base $1\frac{1}{3}$ in that of spinous dorsal, the longest ray $1\frac{1}{5}$ in head. Anal similar to second dorsal, but smaller. First anal spine short, the second but little longer, its length equaling that of snout. Caudal wide, truncate behind, slightly emarginate when fin is not spread. Pectorals equaling distance from front of orbit to tip of opercular spine, the tips of pectorals and ventrals reaching about the same vertical. Ventrals $1\frac{1}{2}$ or $1\frac{2}{3}$ in head.

Scales on body of moderate size, becoming larger and less closely imbricated posteriorly; those on nape and along base of dorsal anteriorly little imbricated, roundish, without spinous points, partially embedded in the skin. Ventral region uniformly scaled, without naked strip or series of caducous plates; no enlarged scale between bases of ventral fins. Head and breast naked, excepting a few embedded scales below and behind eye.

Head, $3\frac{1}{5}$ in length; depth, $5\frac{2}{3}$ to 6. D. XI or XII, 13 or 14; A. II, 11 or 12. Lat. l. $74\frac{1}{6}$. L. $3\frac{3}{4}$ in.

Color: Olivaceous, the back with 8 to 10 dusky cross-bars wider than the interspaces; these dorsal bars usually continuous with an equal number on middle of sides, the latter terminating below lateral line in V-shaped prolongations, much like those in *Etheostoma blennioides*. In one specimen (an adult ♂) the first two bars are partially confluent on sides, the anterior one including the axil and ending in a black spot below pectorals, the second encircling body behind ventral fins; bars behind front of anal in this specimen also completely encircling body. Back and sides marked with many small bright carmine-red spots, irregularly disposed in the light interspaces; in the male specimen they are much more numerous, those on hinder part of body confluent, forming narrow bars, one down the middle of each light space. A dark streak forward and one backward from eye, none downward; opercle and top of head dusky.

Spinous dorsal dusky, the base marked with fine red spots, the fin broadly margined with a bright carmine band. Soft dorsal barred with alternating series of dark and of reddish spots. Caudal with wide bars of dark and red. A pair of small jet-black spots on caudal peduncle at base of median caudal rays. Anal dusky at base. Pectorals and ventrals light orange, indistinctly barred with dusky.

Two specimens, each $3\frac{3}{4}$ inches long, were taken by the writer, in company with Mr. Seth E. Meek, in the headwaters of the Niangua River, near Marshfield, Mo. One of these is deposited in the U. S. National Museum, the other in the museum of the University of Cincinnati.

7. *Etheostoma nianguæ spilotum* Gilbert, subsp. nov. 38319.

Differing from the above in squamation only, the scales being much larger, and the lateral line incomplete in all specimens examined. The scales along anterior portion of base of spinous dorsal have like those on nape lost their ctenoid characteristics, but are not reduced in size, and are still regularly disposed in series continuous with those of sides. In typical *nianguæ* they are much reduced, and not in definite series.

Head, $3\frac{1}{2}$ to $3\frac{3}{4}$; depth, $5\frac{1}{4}$ to $6\frac{1}{8}$. Eye 5 in head, in specimens 2 to 3 inches long. D. X or XI-12 or 13; A. II, 10 or 11. Lat. l. 58 to 60, the pores absent on the posterior 5 to 13 scales, and occasionally on single scales more anteriorly. Eight series of scales between lateral line and base of spinous dorsal.

Color in life: Olive green above, light below; back with 8 dark cross-bars formed of dusky mottlings; continuous with these, or in other cases alternating with them, are 8 V-shaped markings on middle of sides; sides and above spotted with reddish orange occupying the light interspaces. A narrow black bar from upper opercular angle through eye encircling the snout. Pectorals and ventrals translucent,

tinged with light orange. Dorsal translucent, the rays speckled. Spinous dorsal with a narrow red margin, terminating posteriorly in a bright orange-red spot, in advance of which is a large black blotch. A black humeral spot. Two jet-black spots at base of caudal, more or less confluent into one. In all other respects this agrees with the description of typical *niangua*.

Twelve specimens, the largest $2\frac{3}{4}$ inches long, were taken by the writer in Sturgeon Creek, a tributary of the Kentucky River, near Traveler's Rest, Owsley County, Kentucky.

8. *Etheostoma zonale* Cope.

? *E. lynceum* Hay, substitute for *Nanostoma elegans* Hay, Proc. U. S. Nat. Mus., 1880, 493.

This species has been taken in abundance in immediate tributaries of the Ohio River in Southern Ohio and Indiana, in both lowland and mountain streams of Kentucky, Tennessee, and Alabama, and in various streams of Arkansas and Texas. In Alabama it occurs both north and south of the watershed separating the Tennessee and Black Warrior Rivers, and will probably be found in all the streams of Northern and Central Alabama, Mississippi, and Georgia which flow to the Gulf of Mexico. It has not yet been recorded from streams of the Atlantic slope.

Specimens from the same locality vary greatly in coloration and in fin and scale formulæ. It is probable that no tangible varieties can be distinguished in any portion of its known range. The dorsal varies from X-11 to XII-13, the anal is II, 7 or II, 8, and the lateral line ranges from 41 to 53. The green on sides varies from short blotches to wide bars entirely encircling belly and extended on dorsal region. The red on dorsals is usually confined to a series of spots, one at base of membrane between each two spines, but is occasionally developed as a basal band along both spinous and soft portions of fin.

The type specimen of *E. lynceum*, kindly sent me by Professor Hay, is a brightly-marked adult male, showing black spots at bases of dorsal scales, and having the snout somewhat blunter than usual, but agreeing in all other respects with *zonale*. The green bands on sides are not mentioned in the original description, but traces of them can still be seen.

Specimens from Arkansas and the Southwest have been designated a subspecies (*Etheostoma zonale arcansanum* Jordan, Cat. Fish. N. A. 1885, 80; Jordan & Gilbert, Proc. U. S. Nat. Mus. 1886, pp. 5, 13) because their breasts were nearly or quite naked. Characters based on squamation of head and breast are valueless here for even subspecific distinction, as will be seen by the following results of an examination of material from various parts of the country.

In specimens from Cypress Creek Florence, Ala., the following stages in the squamation of the breast were found in different individuals: (1) Breast entirely naked, no scale present anterior to bases of ventral

and pectoral fins; (2) a single scale only, firmly embedded in middle of breast; (3) an additional patch of scales occupying region between base of pectoral fins and gill opening; (4) this patch produced downward and encroaching on the breast proper, which may then have further a transverse band of scales or a V-shaped patch in front of ventral fins. Some or all of these stages have been found in material from the Rolling Fork and the Rockcastle River, in Kentucky, the Chickasawha River, in Mississippi, and the Little Miami River, in Ohio. The majority of specimens show the breast naked and a patch of scales present in advance of pectoral fins. In no specimen examined has the breast been found completely invested.

What is true of the squamation of the breast is true also of the cheeks and opercles. Specimens from the Little Miami River and from Florence, Ala., have these regions scaled, but the scales vary greatly in condition. In some individuals the scales are ctenoid and imbricated, like those on the body; in others they are almost completely embedded in the skin, the spiny points only projecting; in still others they have become thin and weak, are no longer imbricated, and show only cycloid concentric rings. A further stage in this last process would doubtless result in their absorption and entire disappearance. Specimens from the Rolling Fork have the cheeks usually naked, the opercles more or less completely scaled; from the Rockcastle have cheeks and opercles either partly or wholly naked, the scales on cheeks being the first to disappear; from the Washita River, Ark., have cheeks and opercles, entirely scaled, or partly or wholly naked.

It seems at least possible that *zonale* is tending toward entire loss of scales from head and breast, this tendency being independent of local conditions, and therefore pretty equally exhibited throughout the range of the species.

9. *Etheostoma (Rhothœca) blennius* Gilbert & Swain, sp. nov. 36187.

Body exceedingly robust, little compressed, the ventral outline more strongly arched than dorsal outline; greatest depth opposite front of spinous dorsal, the two profiles thence converging rapidly backwards to form the rather long, slender, caudal peduncle. Head very deep, with subvertical cheeks, broad below, narrowing upwards and forwards. Profile from nape to middle of interorbital space nearly horizontal, thence abruptly and very obliquely decurved to tip of snout. Middle of eye equidistant from tip of snout and front of nape. Greatest depth of preorbital two-sevenths length of head.

Mouth very small, subinferior, the lower jaw included. Length of maxillary equaling distance from tip of snout to anterior nostril. Pre-maxillaries not protractile, the fold of upper lip interrupted by a very narrow frenum, as is the case in some specimens of *Etheostoma simoterum*, to which *blennius* seems closely related. Vomer with teeth. Opercular spine very little developed, the opercle terminating in a flat point,

scarcely projecting beyond the membrane. Gill-membranes very widely joined across isthmus, the width of the union being two-thirds distance from posterior margin of membrane to tip of lower jaw. Eyes small, high up, their diameter two-thirds snout and $4\frac{1}{2}$ in head.

Spinous dorsal long and rather low, composed of stiff spines, the membrane of last spine joining base of first soft ray; the middle spines the highest, about half length of head. Second dorsal shorter and higher than the first, much larger than the small anal fin, its longest ray $1\frac{2}{5}$ in head. Anal spines short and robust, the first longer than second; longest anal ray about equaling length of snout. Caudal lunate. Pectorals very large, reaching much beyond ventrals, about one-third length of body. Length of ventrals equaling distance from snout to base of pectorals. Least depth of caudal peduncle two-fifths depth of body.

Body covered with very large scales, those on nape somewhat smaller. Head and breast wholly naked. Lateral line complete, straight.

Head $4\frac{2}{7}$ in length; depth $4\frac{3}{7}$. D. XII, 12; A. II, 8. Lateral line, $43\frac{5}{8}$. Length, $2\frac{4}{5}$ inches,

Color in life: Light olive-green above, with four conspicuous blackish-brown cross-bars, narrower than the interspaces, running from back downward and forward to below lateral line; the first, very broad, occupies the entire nape, and terminates above base of pectorals; the second, much narrower, begins below end of spinous dorsal; the third below last rays of soft dorsal; the last bar, much less conspicuous, on back of caudal peduncle. On middle of each light interspace is a similar, somewhat broader, bar, less clearly marked, and with ill-defined boundaries. These bars terminate below lateral line in seven or eight dusky blotches. Each scale on back and sides with the central portion light red, changing to golden brown in spirits. Belly and lower fourth of sides silvery-white. Two bright areas at base of caudal, with a blackish bar immediately behind them; caudal indistinctly barred with dusky. Dorsals translucent, the membrane between each two rays with an elongate dusky-red blotch, extending two-thirds height of fin; spinous dorsal margined with light red. Pectorals barred with dusky and light-yellowish. Ventrals with traces of similar bars. Anal translucent, an indistinct yellowish band along its middle.

Two specimens were taken near Florence, Ala., by the writer and Mr. Joseph Swain, the largest of these (the type of the present description, numbered 36187 on the register of the National Museum) in Cox's Creek, the smaller in Shoal Creek—clear, rapid streams, tributary to the Tennessee River.

This species is very close to *Etheostoma inscriptum* Jordan & Brantton, but differs from published descriptions of the latter in form, in some details of coloration, and in the smaller eye. We have had no specimens of *inscriptum* with which to compare it.

10. *Etheostoma* (*Rhthœca*) *rupestre* Gilbert & Swain, sp. nov. 36695.

Closely related to *Etheostoma thalassinum*, from which it may be distinguished by its more slender form, the absence of bright coloration, the smaller scales, and the squamation of the opercle.

Body slender, fusiform, little compressed, the upper anterior profile descending rapidly to tip of snout. Mouth small, horizontal, terminal, at lower side of snout, the lower jaw included; maxillary reaching vertical from front of orbit, its length slightly less than diameter of eye, $3\frac{1}{2}$ in head in specimens $1\frac{1}{2}$ inches long. Interorbital space very narrow, its width half diameter of orbit. Gill-membranes widely joined, free from the isthmus.

Scales small, 6 to 7 longitudinal series between lateral line and the base of the spinous dorsal; tubes of lateral line usually 55 or 56 in number, varying from 50 to 57. Lateral line complete, straight. Opercle more or less completely covered with scales as large as those on sides; cheeks and breast naked, the nape closely scaled.

Fins of moderate size, the spines weak and flexible. Length of dorsal spines equaling distance from tip of snout to middle of orbit. Anal spines short, about equal in size, their length less than diameter of orbit. Pectorals long, reaching beyond vertical from vent, their length 3 to $3\frac{1}{2}$ times in length of head and body. Ventrals reaching vent. Caudal short, not deeply notched, $4\frac{1}{2}$ in length.

Head, $3\frac{1}{2}$ to 4 in length; depth, $5\frac{3}{4}$. D. XI or XII—11 or 12; A. II, 7 (8). Lat. 1. 50 to 57; 6 or 7 series above lateral line.

Coloration in life: Grass green, with darker markings, but no red or blue. Back with six dark cross-bars, wider than the light interspaces. A series of six dark blotches, sometimes W-shaped, along sides immediately below lateral line. Usually four dark spots at base of caudal, two of which are closely approximated at base of median caudal rays. Dark vermiculations on top of snout; a dark bar downwards, and one downwards and forwards from eye. Fins with wavy dusky bars.

Numerous specimens were taken by us in North River, a tributary of the Black Warrior, near Tuscaloosa, Ala. It may prove to be a subspecies of *thalassinum*, but we cannot at present so determine it.

11. *Etheostoma* (*Etheostoma*) *saxatile* Hay. 36628, 36630, 36736.

Numerous specimens from various localities enable us to contribute the following points to our knowledge of this species:

With much the habit of *E. olmstedii*, but the snout slender and sharp, with gently decurved profile and the mouth terminal, nearly horizontal. Lower jaw included; maxillary extending scarcely beyond vertical from front of eye. Preopercle entire; opercular spine developed. Gill membranes evidently but rather narrowly united across isthmus.

Pectorals reaching somewhat beyond ventrals, about as long as head, not nearly reaching vent. Ventrals not extending two thirds distance to front of anal, equaling distance from snout to preopercle. Dorsal fins well separated, the interval between them equaling two-thirds diam.

eter of orbit; dorsal spines very slender and fragile, the longest equaling longest soft ray, and half length of head. Anal spines slender, about equal in length, the anterior the stronger, one-third length of head; soft anal rays equal half distance from snout to base of pectorals. Caudal shallowly lunate.

Scales strongly etenoid, uniformly covering body except breast, those on nape smaller; opercles and upper portion of cheeks closely scaled, head otherwise naked. *No enlarged black humeral scale.* Lateral line reaching about to end of soft dorsal, on 30 to 45 scales.

Head, $3\frac{3}{4}$ to 4 in length; depth, 6. D. XI to XIII—11 to 12; A. II, 9. Lat. 1. 50 to 55. Five longitudinal series between lateral line and base of spinous dorsal.

Color in life: Olivaceous, with six dark cross-bars on back, and with dark tessellations which follow the same pattern as in *E. olmstedii*, those on upper parts light brownish red, instead of dusky; the M-shaped marks along sides dusky, serving, in the brighter specimens only, as the starting points for light-blue bands which more or less completely encircle belly and caudal peduncle. No other bright markings. A narrow dark streak from eye to snout; an indistinct dark streak below, and a black spot behind eye. Dorsals and caudal inconspicuously barred. A pair of minute jet-black spots at base of median caudal rays, more conspicuous in the young. Opercle dusky.

This species has undoubtedly a very wide distribution. Originally described by Professor Hay from the Chickasawha River, it was during the summer of 1884 found to be abundant in tributaries of the Clinch River near Clinton, Tenn., in the Black Warrior River at Morris, and at Tuscaloosa, Ala., and in the Saline and Washita Rivers in Arkansas. Our specimens have been compared with the original types, with which they agree in all respects. The frenum joining the premaxillary to the forehead is very narrow and easily ruptured, the upper jaw then appearing protractile. Occasionally the fold is continuous, no frenum being present, the species varying in this respect like *E. simoterum*.

12. *Etheostoma (Etheostoma) luteovinctum* Gilbert & Swain, sp. nov. 36139.

Body compressed, the back elevated, the profile descending rapidly forward, and gradually towards tail, from front of spinous dorsal; caudal peduncle very slender. Head compressed, with a short high snout, the upper profile of which descends in a strong curve. Mouth at lower level of muzzle, which does not project beyond it; mandible included. Gape nearly horizontal, of moderate size, the maxillary reaching vertical from front of pupil, $3\frac{1}{2}$ in head. Cheeks and opercles scaled. Preopercle entire. Opercular spine present. Branchiostegal membranes narrowly joined across isthmus. Eye rather large, longer than snout, $3\frac{1}{2}$ to 4 in head.

Dorsals short and low, well separated from each other; base of spinous dorsal equaling length of caudal peduncle, and but little longer than that of soft dorsal. Highest dorsal spine half length of head; the

highest soft ray $1\frac{3}{8}$ in head. Anal spines of about equal length, both slender and rather high, $\frac{1}{3}$ length of head. Pectorals as long as head; ventrals $1\frac{2}{7}$ in head.

Cheeks, opercles, and nape closely scaled, the breast naked or partially scaled. No black humeral scale. Lateral line nearly straight, continued to below middle of second dorsal, running on 30 to 35 scales.

Head, $3\frac{2}{3}$ to 4 in length; depth, $4\frac{1}{2}$ to 5. D. IX or X—13; A. II, 7 or 8. Lat. l. 49 to $55\frac{6}{11}$. Length, 2 inches.

Colors in life: Very light pale olive, with 7 dusky cross-bars on back narrower than the interspaces, and reaching about half way to lateral line, their ends connected by dusky lines. Below lateral line about 9 dusky-greenish blotches, between which are orange-yellow cross-bars, most distinct posteriorly, not reaching median ventral line. No distinct streak forward from eye; a dusky bar below eye; snout dusky. Small black spots at base of caudal. Soft dorsal and caudal barred with dusky. Spinous dorsal with a black blotch on posterior rays, a yellow or orange bar through middle of fin, the base and margin dusky. Anal fin unmarked.

Five specimens were obtained from a quiet gravelly spot in Stone River near Nashville, Tenn.

13. *Etheostoma* (*Etheostoma*) *parvipinne* Gilbert & Swain, sp. nov. 36716.

Body compressed, little tapering, the caudal peduncle deep, its depth approximately equal throughout. Head small and broad, with very short snout which is abruptly somewhat blunt, its tip about on a level with axis of body, the dorsal outline descending to it equally as the ventral outline rises. Mouth small, with broad, oblique cleft, the maxillary reaching beyond vertical from front of orbit, $3\frac{3}{4}$ in head. Teeth on vomer and palatines. Eye $4\frac{1}{5}$ in head, equaling distance from tip of snout to front of pupil. Interorbital width $\frac{2}{3}$ diameter of orbit, with a median furrow. Preopercular margin entire. Gill membranes very broadly joined across isthmus, the distance on median line from their posterior border to articulation of mandible equaling diameter of orbit. Cheeks, opercles, nape and breast closely scaled.

Spinous dorsal low and of weak spines, the median portion highest, the outline descending gradually either way; the highest spine $2\frac{1}{2}$ in head. The two dorsals scarcely joined at base. Second dorsal small, its base equaling length of head in front of preopercular margin, the longest ray half length of head. Anal spines rather weak, the second longer and somewhat stronger than the first. Caudal rounded. Pectorals and ventrals both very short, their tips reaching about the same vertical, the ventrals scarcely extending half way to vent. Pectorals equaling head behind middle of eye.

Scales weakly ctenoid, those on head, nape, and breast smooth. Opercular scales about as large as those on body, those on cheeks, interopercles, breast and nape much smaller; lateral line nearly straight, with a slight arch anteriorly, wanting on three or four scales only.

Head, $4\frac{1}{6}$ in length; depth, $4\frac{3}{4}$. D. XI-10; A. II, 7. Lateral line, $48\frac{6}{13}$.

Color: Dusky olive above and on sides, dusted with fine dark points. Eleven or twelve faint dark cross-blotches on back, and a corresponding number on middle of sides below lateral line. Lower part of sides and the ventral region unmarked. Two small black spots at base of caudal. Spinous dorsal with about two irregular series of black spots; soft dorsal and caudal speckled; other fins unmarked. A dark bar below eye, none in front or behind.

A single specimen, 2 inches long, was obtained in a small spring-branch tributary to the Black Warrior River, at Tuscaloosa, Ala. It is numbered 36716 on the National Museum register.

14. *Etheostoma (Etheostoma) punctulatum* Ag. 36240, 36212.

Body slender, compressed, the ventral outline nearly straight, the back scarcely elevated; upper profile descending in a gentle regular curve from front of dorsal to snout, which is below axis of body. Snout sharp; mouth terminal, moderately oblique, large, the maxillary reaching vertical from middle of pupil, 3 in head; premaxillaries not protractile. Eye large, $3\frac{1}{2}$ in head; the snout $4\frac{1}{3}$. Teeth on vomer and palatines; outer series in upper jaw enlarged. Preopercle entire; opercular spine very slender. Branchiostegal membranes not united across isthmus.

Fins rather small. Pectorals and ventrals about equal, the latter not nearly reaching vent, as long as from snout to nape. Dorsals not joined at base, the spines rather strong. Anal with two slender subequal spines, as long as diameter of orbit, the first stronger than second. Caudal truncate.

Body covered with small etenoid scales, which become very fine on the nape; breast naked. An enlarged black humeral scale; cheeks and opercles naked. Lateral line straight, ending below last rays of soft dorsal, the tubes wanting on about 20 scales.

Head, $3\frac{1}{3}$ in length; depth $5\frac{2}{3}$. D. X or XI-14; A. II, 8 or 9.

Lateral line 63 to 73, about 9 series above it. Length 2 inches.

Colors in life: Very dark slaty-green, with indistinct darker bars, irregular in number and size, downwards from back. Belly and branchiostegal membranes deep orange-red. Sides of head coarsely punctate with black; top of head dusky, a dark bar forwards from eye, one upwards and backwards across upper portion of cheek and opercle, and a broad bar downwards to behind the mandible. A conspicuous black humeral spot. Usually a darker area at base of caudal, one below soft dorsal, and a dusky bar in axil of pectorals ending below the fin in a blackish blotch. Spinous dorsal dusky-green at base, a broad black bar through its middle, more conspicuous anteriorly, its margin reddish; second dorsal, caudal, and pectorals light reddish, with indistinct

wavy bars formed of black punctulations; anals and ventrals dusted with coarse black specks.

This species is abundant in small streams in the Ozark region of Southwestern Missouri. It was taken by Mr. S. E. Meek and the writer in the Sac River near Greenfield, and in the Niangua River, the James, and the Osage Fork of the Gasconade Rivers, near Marshfield, Mo.

15. *Etheostoma (Etheostoma) whipplei* Girard. 36353, 36442, 36377, 1331, 36419, 36818, 36735.

Closely related to *Etheostoma punctulatum* from which it differs conspicuously in its deeper, more compressed body, thicker caudal peduncle, coarser scales, smaller eye, the union of the branchiostegal membranes across the isthmus, and the different coloration.

Body rather deep, compressed; least depth of caudal peduncle equaling length of snout and eye. Mouth terminal, oblique, maxillary reaching vertical from front of pupil, $3\frac{1}{2}$ in head. Premaxillaries not protractile. Eye moderate, slightly greater than snout, $4\frac{1}{4}$ in head. Preopercle entire; opercular spine strong. Branchiostegal membranes rather widely joined across isthmus.

Fins larger than in *punctulatum*; dorsals slightly joined at base, the longest soft ray half length of head; pectorals somewhat longer than ventrals, which equal distance from snout to preopercular margin; first anal spine longer and much stronger than second; caudal truncate.

Scales small; lateral line straight, ending under last rays of soft dorsal, the pores wanting on 16 to 20 scales. Opercles with a few large etenoid scales. Breast and ventral region, cheeks, nape, and a strip along base of spinous dorsal anteriorly, naked or with embedded, cycloid scales.

Head $3\frac{1}{2}$ in length; depth $4\frac{1}{2}$ to 5. D. IX to XII-12 to 14; A. II, 7. Lateral line 60 to 70, 8 or 9 series between it and base of spinous dorsal.

Colors in life: Grayish, mottled with darker, and with about 12 indistinct dusky bars, becoming more clearly marked posteriorly; scales of lighter interspaces on sides, with small, round, bright, orange-red spots, those near lateral line in longitudinal series of two to five. Two orange blotches at base of caudal. A dark spot below eye, and two behind it—one of these on upper part of cheeks, the other, fainter, on occiput. A conspicuous black humeral spot.

Spinous dorsal dusky-translucent at base, a dark bar about half way up, then a translucent bar, an orange-red bar, and a translucent bar tipped with dusky; soft dorsal similarly marked, with more yellowish. Anal like soft dorsal, the orange brighter, sometimes covering distal half of fin, the basal dusky area fainter. Caudal barred with light and dark, and margined with black; sometimes with a submarginal band of orange.

Occurring abundantly in the Poteau River near Hackett's City, the Saline River at Benton, and the Washita River at Arkadelphia, Ark-

16. *Etheostoma whipplei alabamæ* Gilbert & Swain, subsp. nov.

It has seemed desirable to assign subspecific rank to specimens collected by Mr. Swain and the writer in the Black Warrior River near Morris and Tuscaloosa, Ala. We have found no difference between these and typical *whipplei*, from the West, except the constantly larger scales in *alabama*. There are usually from 50 to 56 in the lateral line, occasionally 58, and in one instance as low as 43. There are 7 or 8 series between lateral line and base of spinous dorsal, these being reduced to 4 in the single instance referred to above. The pores of the lateral line are wanting on about 12 scales. In all other details of color, proportions and fin-formulæ, the two forms appear not to differ. A single specimen from Arkadelphia, Ark., has the lateral line 48. This must be a very exceptional irregularity, as in the count of some 30 specimens from Arkansas, none other was found with less than 60 scales.

* 17. *Etheostoma cragini* Gilbert. 38320.

Head and body heavy and not closely compressed, the back not elevated, the caudal peduncle deep; snout short and broad, less than diameter of orbit, 5 in head; mouth terminal, broad, little oblique, the lower jaw included; the maxillary scarcely reaching vertical from front of pupil, $3\frac{1}{2}$ in head. Premaxillaries non-protractile. Eye large, much longer than snout, equaling length of maxillary. Interorbital space narrow, less than diameter of pupil. Preopercle entire; opercle ending in a short flat point, the spine poorly developed. Gill membranes somewhat narrowly joined across the isthmus. A conspicuous black humeral scale.

Fins small, the pectorals reaching but little beyond tips of ventrals, $1\frac{1}{3}$ in head. Spinous dorsal low, the spines strong, the longest about $\frac{2}{3}$ length of head. Anal fin very small; first anal spine longer and stronger than the second, $3\frac{1}{2}$ in head. Caudal truncate, equaling length of pectorals.

Scales weakly ctenoid, uniformly covering body including nape and ventral region, becoming somewhat smaller anteriorly on sides; cheeks and opercles with few scales or none, head and breast otherwise naked.

Head $3\frac{1}{3}$ in length; depth $4\frac{3}{4}$. D. VIII or IX, 10 to 12 (VI, 12 in one specimen, probably abnormal); A. II, 6 or 7. Lateral line 46 to 50, the tubes present on 15 to 20 scales; 6 or 7 series of scales above lateral line. Length $1\frac{1}{2}$ inches.

Color in spirits: Olivaceous, much mottled with dusky above; lower half of sides sprinkled with coarse black specks, and with traces of two silvery lines; middle of sides with a series of about 12 dusky spots as large as pupil, the interspaces silvery; a black spot on opercle, one behind and one below orbit; snout dusky. Caudal conspicuously barred with light and dark; soft dorsal and anal faintly barred; spinous dorsal

* This description appeared originally in the "Bulletin of the Washburn College Laboratory" for March and April, 1885, p. 99.

translucent, dusted with minute dark points, margined with blackish. Traces of orange markings on lower side of head, and on bases of pectoral fins; caudal apparently tinged, in life, with light yellow.

Several specimens were collected and forwarded to the writer by Prof. F. W. Cragin, who took them in a small weedy stream connecting the "Lake" at Garden City, Kans., with the Arkansas River. A single specimen was also taken in Snokomo Creek, Wabaunsee County, Kansas.

18. *Etheostoma* (*Etheostoma*) *tuscumbia* Gilbert & Swain, sp. nov. 36154.

Body exceedingly heavy and robust, with elevated back, and broad, thick head. Anterior profile descending rapidly from front of dorsal, the snout blunt and broadly rounded, but not overhanging the mouth. Gape large and wide, the mandible little included, the maxillary reaching vertical from middle of orbit, 3 in head. Eye rather small, $4\frac{1}{3}$ in head, the interorbital width two-thirds its diameter. Preopercular margin entire. Cheeks, opercles, nape, and top of head generally scaly, only the snout, interorbital space, and preorbitals naked. Opercular spine little developed. Branchiostegal membranes scarcely joined across isthmus.

Fins all very small. Dorsal spines weak, the median spines highest, half length of head; soft dorsal scarcely higher than spinous; anal fin with a single, rather weak spine, the first soft ray articulated and branched. Pectorals and ventrals very small, the latter not reaching $\frac{2}{3}$ distance to vent; length of pastorals equaling distance from tip of snout to preopercular margin. Caudal broadly rounded.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; depth 4 to $4\frac{1}{2}$. D. IX or X, 11 to 13; A. I, 8. Lateral line $50\frac{6}{10}$ or $50\frac{7}{10}$. Length 2 inches.

Scales rough, wholly enveloping head and body except snout and interorbital space. Lateral line incomplete, arched, following the curve of the back. Pores absent on 15 to 18 scales.

Color in life: Varying shades of grayish and greenish olive, much mottled and speckled with black. Six broad, dark bars across back; 8 or 10 linear black blotches along lateral line separated by silvery interspaces. A dark streak before, one below, and one behind orbit. Opercle and top of head dusky. Pectorals with several dark bars, ventrals unmarked. A black blotch at base of each caudal lobe. Other fins more or less barred with light and dark.

This species differs from all those hitherto referred to the group *Etheostoma* in having a single anal spine, and will have to form the type of a new genus, if we attempt to recognize as genera such groups as *Nanosotoma*, *Nothonotus*, *Hadropterus*, &c.

Etheostoma tuscumbia was found exceedingly abundant in the stream flowing from the large spring at Tuscumbia, Ala.

19. *Etheostoma* (*Alvarius*) *fonticola* Jordan & Gilbert, sp. nov. 36523.

Moderately compressed and elevated, the two outlines about equally arched; head short and deep, with very short snout; mouth terminal,

oblique, rather large, the lower jaw slightly included; maxillary reaching vertical from pupil, rather more than $\frac{1}{3}$ length of head. Eye large, $3\frac{1}{2}$ in head, much longer than the snout or the narrow interorbital space. Gill membranes moderately joined across the isthmus, uniting in an acute angle. Opercular spine well developed. Premaxillaries non-protractile.

Fins small; the spinous and soft dorsals well separated; *the anal with a single rather strong spine* in all specimens seen. Length of pectorals equaling length of head behind front of eye. Longest dorsal spine equaling length of snout and eye.

Scales large, covering sides and ventral region uniformly; nape, breast, and cheeks naked, opercles scaled. Pores of lateral line present on one or two scales next the head, only.

Head, $3\frac{2}{3}$ in length; depth, 5. D. VI-10: A. I, 7. Lat. l. 34. Length about 1 inch.

Color in life: Olivaceous, the scales on sides broadly margined behind with dusky. Dorsal region dusted with fine dark specks, and with about 8 indistinct dusky cross-blotches. A series of horizontal stitch-like dark lines along middle of sides, forming an interrupted lateral streak. Three small dark spots at base of tail. A dark spot on opercle. A dark bar before, one below, and one behind eye. Soft parts of vertical fins with light and dark bars. Lower half of spinous dorsal jet-black; above this a broad red band, the fin narrowly edged above with black.

Taken in small numbers in the San Marcos River, near San Marcos, Tex. It resembles in most details *Etheostoma praeliare* and *microperca*,* but differs in the constant presence of but one anal spine, in the bright coloration of the spinous dorsal, and in the somewhat larger mouth; from *praeliare* it differs also in having naked cheeks. It does not seem very improbable that these three species may eventually be reduced to one. But few specimens have been examined, and nothing is known concerning their variability. Of the two specimens of *praeliare* thus far known, one has two anal spines, and the other but one.

Alvarius lateralis Grd. is a closely related species and may even be identical with the above. It is said, however, to have the lower jaw longer than the upper, and the cheeks and opercles scaly; no anal spine was observed, and nothing said with regard to length of lateral line. In our ignorance concerning these points we have not thought it best to make the identification.

UNIVERSITY of CINCINNATI,

December 9, 1886.

* *Etheostoma microperca* Jordan & Gilbert = *Microperca punctulata* Putnam. The name *punctulatum* is preoccupied in *Etheostoma*.